OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **CENTER POND** the program coordinators recommend the following actions. *Thank you for increasing your sampling program this year! Since weather and watershed conditions change throughout the summer more data points help to explain the water quality in the Pond.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *variable* in-lake chlorophyll-a trend. The increase in the chlorophyll-a concentration in August was most likely caused by the abundance of algae at that time. The average chlorophyll concentration remained below the state mean reference line for the second consecutive year. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *slightly improving* trend in lake transparency. There was a slight decrease in transparency in August due to the increase in chlorophyll-a concentration. The average clarity this year was below the mean reference line. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time! These graphs show an *improving* trend for in-lake phosphorus levels, which means levels are decreasing. There was an increase in the phosphorus concentration in the lower water layer in August. The depletion of oxygen in the lower water layer of the pond can cause phosphorus to be released from the sediments into the water column. Sampling more often during the summer will help to track changes in phosphorus concentrations in the pond. The average epilimnetic phosphorus has been below the state median since 1995. This year's average hypolimnetic phosphorus was just below the state median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Conductivity levels in the hypolimnion, End Camp Brook, and the Outlet were reduced from last year (Table 6). This was most likely a result of the excess rains, which tend to flush pollutants out of the waters. Conductivity increases often indicate the influence of human activities on surface waters. This decreasing trend is a positive sign. Septic system leachate, agricultural runoff, iron deposits, and road runoff can all influence conductivity.

- The phosphorus concentration at the Boat Landing was high this year (Table 8). This site was sampled in June, but not in August. We don't have any other records for this sample site, although we do have records for a Launch Inlet. These may be two different names for the same inlet. If the volunteer would be so kind to add the location of the Boat Landing, and if there is an inlet, to the map in Appendix C we can then make the necessary changes to our records.

- Dissolved oxygen was again low at the bottom three meters of the pond (Table 9). When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. This explains the higher hypolimnetic phosphorus in August versus the epilimnetic phosphorus.

- An observation was made this summer during our annual visit regarding a resident of the lake clear-cutting and removing stumps near the lakeshore (see Notes section below). The volunteer stated that the local Conservation Commission had interjected, but the DES Shoreland Protection Section was not consulted. There are rules and regulations in place in New Hampshire to protect our waters by setting a 250 foot buffer strip around our public waters. Excessive tree and brush removal increases the amount of erosion, phosphorus and other pollutants to the lake via runoff. If this situation occurs again in the future, contact the DES Shoreland Protection Section at (603) 271-3503 to report the violation.

NOTES

- Monitor's Note (6/25/00): Blue heron was seen. Saw 1 bass boat on pond, man said fishing was poor.

- Monitor's Note (8/30/00): Sponges growing at outlet. Clear-cutting and stump removal has occurred at one residence on the lake.

USEFUL RESOURCES

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

In Our Backyard. 1994. Terrence Institute, 4 Herbert St., Alexandria, VA. 22305, or call (800) 726-4853.

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

Handle With Care: Your Guide to Preventing Water Pollution. Terrene Institute, 1991. (703) 661-1582.

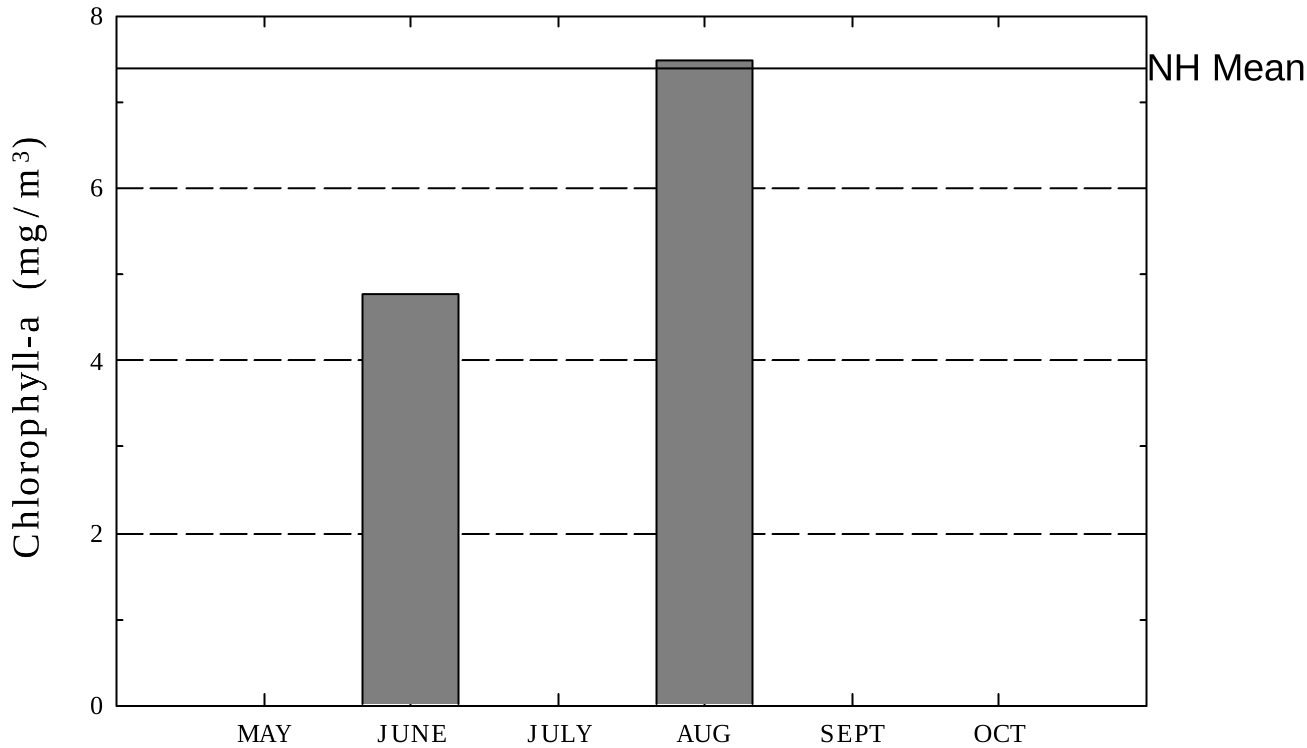
Aquatic Plants and Their Role in Lake Ecology, WD-BB-44, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Native or Naturalized Shoreland Plantings for New Hampshire. NHDES Shoreland Protection Program. (603) 271-3503

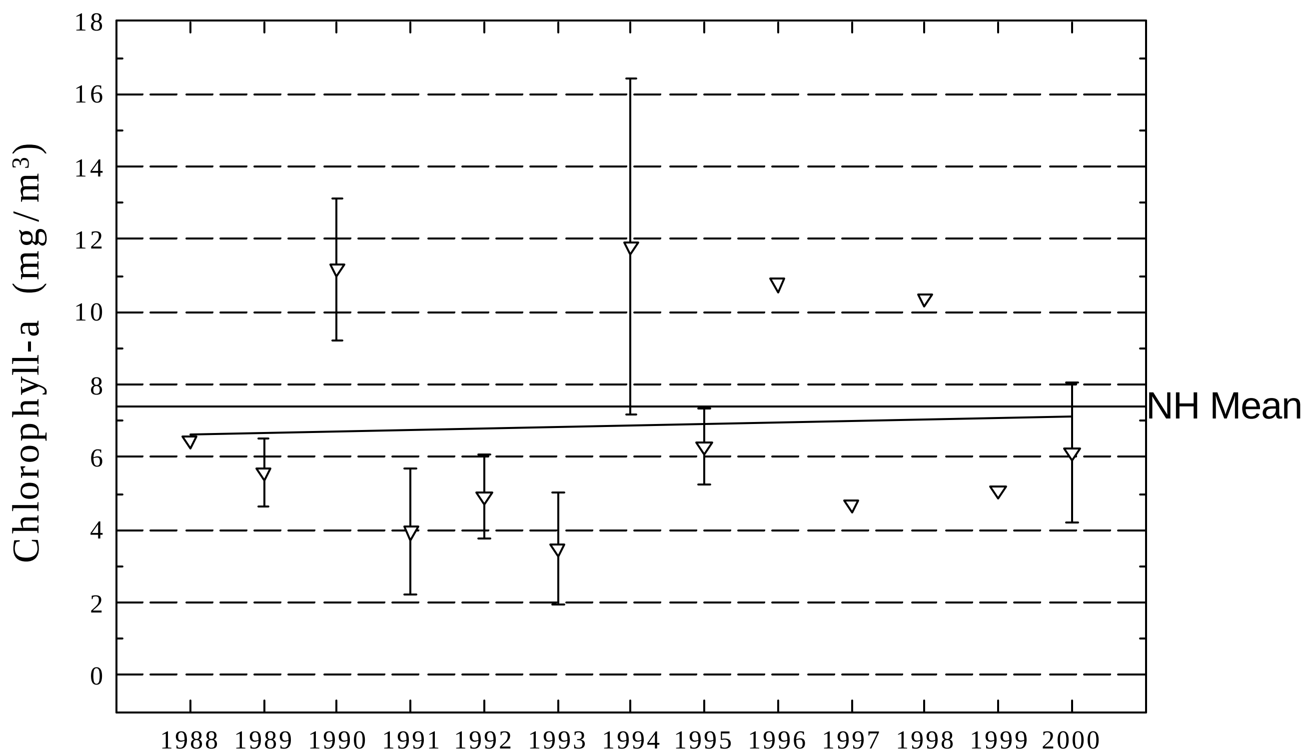
Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Center Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



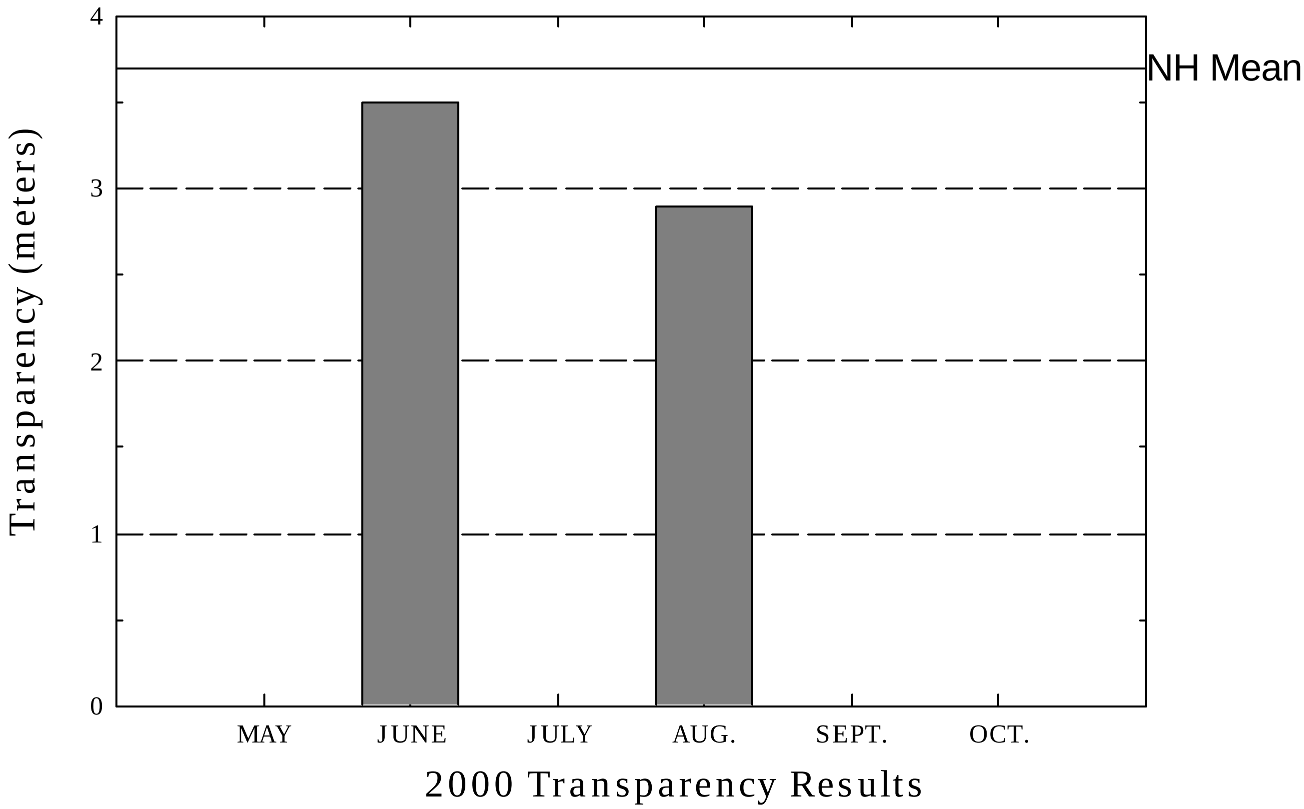
2000 Chlorophyll-a Results

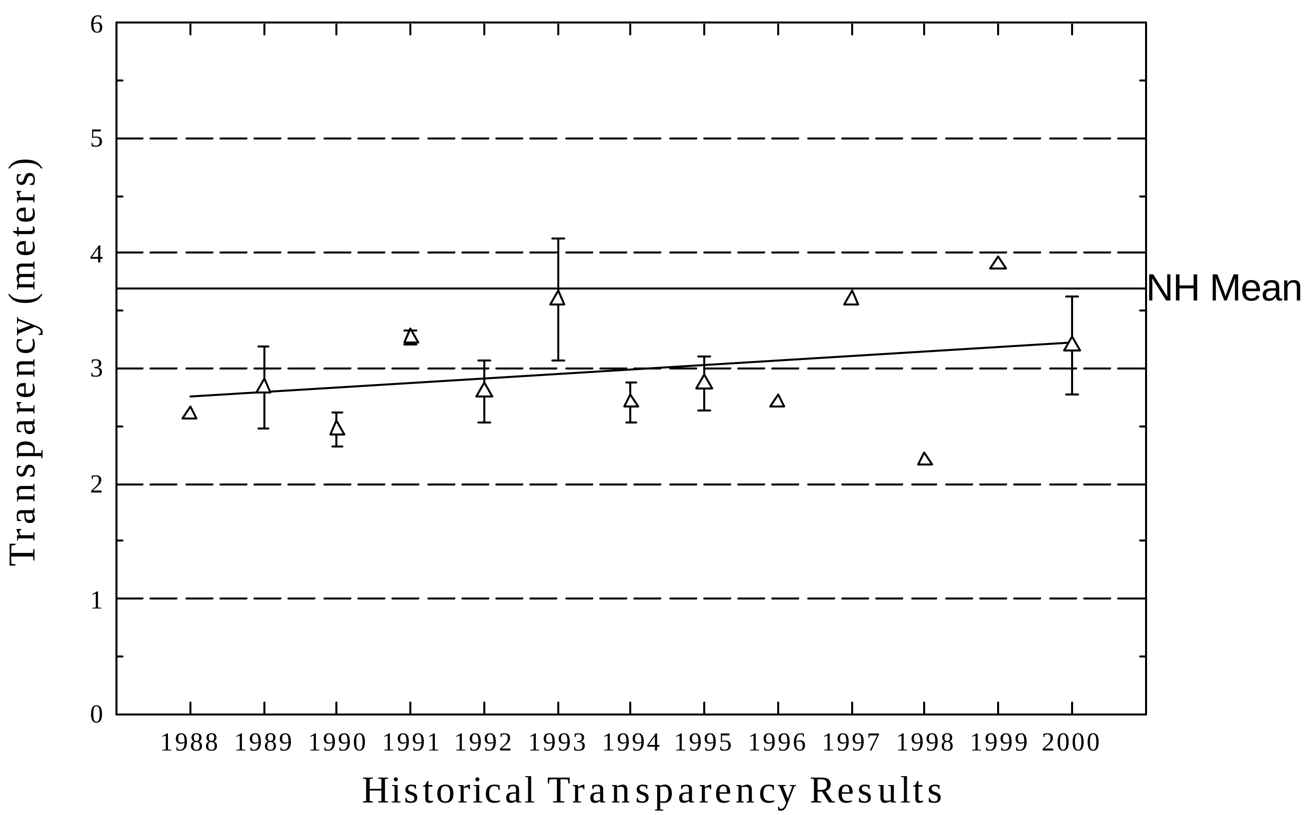


Historical Chlorophyll-a Results

Center Pond

Figure 2. Monthly and Historical Transparency Results





Center Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

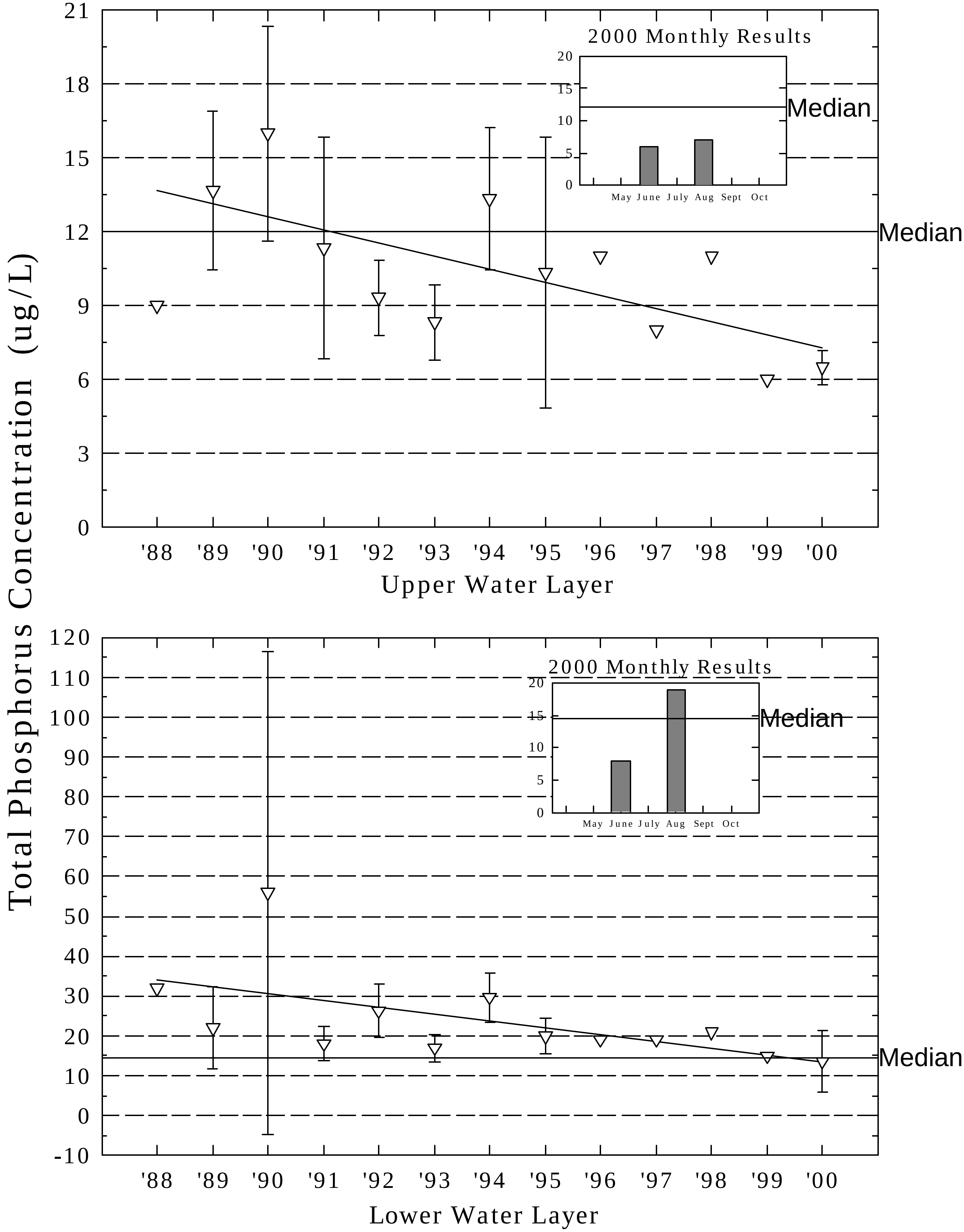


Table 1.

CENTER POND
STODDARD

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1988	6.46	6.46	6.46
1989	4.74	6.56	5.58
1990	9.51	13.34	11.18
1991	2.02	5.30	3.96
1992	3.60	5.73	4.93
1993	2.54	5.26	3.50
1994	7.25	16.47	11.81
1995	5.15	7.17	6.29
1996	10.79	10.79	10.79
1997	4.72	4.72	4.72
1998	10.38	10.38	10.38
1999	5.10	5.10	5.10
2000	4.77	7.49	6.13

Table 2.

CENTER POND

STODDARD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06 / 13 / 1989	RIZOSOLENIA	63
07 / 10 / 1990	ASTERIONELLA	26
	MELOSIRA	25
06 / 20 / 1991	SYNURA	46
	ASTERIONELLA	41
	PERIDINIUM	13
06 / 27 / 1992	DINOBRYON	53
	TABELLARIA	19
	CHRYSOSPAERELLA	11
06 / 30 / 1993	RHIZOSOLENIA	57
	ASTERIONELLA	31
07 / 25 / 1994	RHIZOSOLENIA	35
	SYNEDRA	14
	EUDORINA	19
06 / 12 / 1995	DINOBRYON	63
	CHRYSOSPHAERELLA	17
	ASTERIONELLA	8
07 / 16 / 1996	DINOBRYON	55
	RHIZOSOLENIA	19
	CHRYSOSPHAERELLA	14
07 / 24 / 1997	DINOBRYON	16
	ASTERIONELLA	13
	ELAKATOTHRIX	10
07 / 21 / 1998	RHIZOSOLENIA	89
	MELOSIRA	7
	MALLOMONAS	2
07 / 12 / 1999	CHRYSOSPHAERELLA	63
	RHIZOSOLENIA	12
	TABELLARIA	8

Table 2.

CENTER POND

STODDARD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08 / 30 / 2000	RHIZOSOLENIA	37
	CHRYSOSPHAERELLA	28
	TABELLARIA	12

Table 3.

CENTER POND

STODDARD

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1988	2.6	2.6	2.6
1989	2.5	3.2	2.8
1990	2.3	2.6	2.4
1991	3.2	3.3	3.2
1992	2.6	3.1	2.8
1993	3.0	4.0	3.6
1994	2.5	2.8	2.7
1995	2.6	3.0	2.8
1996	2.7	2.7	2.7
1997	3.6	3.6	3.6
1998	2.2	2.2	2.2
1999	3.9	3.9	3.9
2000	2.9	3.5	3.2

Table 4.

CENTER POND
STODDARD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
BOAT LANDING				
	2000	5.45	5.45	5.45
END CAMP BROOK				
	1988	5.15	5.15	5.15
	1989	5.31	5.77	5.50
	1990	5.16	6.15	5.53
	1991	4.79	5.70	5.04
	1992	5.85	6.00	5.94
	1993	5.98	6.23	6.09
	1994	4.86	5.74	5.11
	1995	5.03	6.18	5.45
	1996	4.96	4.96	4.96
	1998	5.87	5.87	5.87
	1999	6.11	6.11	6.11
	2000	5.94	6.16	6.04
EPILIMNION				
	1988	6.14	6.14	6.14
	1989	5.92	6.35	6.07
	1990	5.76	6.28	6.03
	1991	6.19	6.41	6.32
	1992	6.25	6.94	6.46
	1993	6.10	6.41	6.24
	1994	6.15	6.34	6.26
	1995	5.89	6.64	6.19
	1996	5.71	5.71	5.71
	1997	6.13	6.13	6.13

Table 4.

CENTER POND
STODDARD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1998	6.17	6.17	6.17
	1999	6.38	6.38	6.38
	2000	6.01	6.18	6.09
HYPOLIMNION				
	1988	5.78	5.78	5.78
	1989	5.69	6.04	5.85
	1990	5.64	5.81	5.69
	1991	5.63	5.91	5.76
	1992	5.73	5.82	5.77
	1993	5.54	6.20	5.79
	1994	5.51	5.80	5.64
	1995	5.90	6.03	5.95
	1996	5.52	5.52	5.52
	1997	5.75	5.75	5.75
	1998	6.08	6.08	6.08
	1999	5.60	5.60	5.60
	2000	5.58	6.00	5.74
LAUNCH INLET				
	1988	5.45	5.45	5.45
	1989	5.30	5.56	5.41
	1990	5.52	5.52	5.52
	1991	5.14	6.33	5.49
LEFT OUTLET				
	1988	6.17	6.17	6.17
	1989	5.95	5.95	5.95

Table 4.

CENTER POND
STODDARD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1988	6.10	6.10	6.10
	1989	5.73	5.75	5.74
	1990	5.66	5.90	5.80
	1991	6.19	6.36	6.24
	1992	6.14	6.45	6.22
	1993	5.65	6.15	5.89
	1994	3.08	6.19	3.56
	1995	5.88	6.43	6.13
	1996	5.56	5.56	5.56
	1997	5.67	5.67	5.67
	1998	5.53	5.53	5.53
	1999	5.64	5.64	5.64
	2000	5.52	5.58	5.55
OUTLET				
	1989	6.23	6.32	6.27
	1990	5.91	6.22	6.09
	1991	6.15	6.20	6.17
	1992	6.14	6.31	6.23
	1994	5.91	5.91	5.91
	1995	5.99	6.25	6.13
	1997	6.17	6.17	6.17
	1999	6.19	6.19	6.19
	2000	5.93	5.93	5.93

Table 5.

CENTER POND

STODDARD

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1988	1.50	1.50	1.50
1989	1.60	1.80	1.73
1990	1.20	1.60	1.33
1991	1.40	1.90	1.73
1992	0.70	2.90	1.70
1993	1.30	2.50	1.77
1994	1.40	2.00	1.73
1995	1.40	2.00	1.67
1996	0.80	0.80	0.80
1997	1.80	1.80	1.80
1998	1.20	1.20	1.20
1999	1.70	1.70	1.70
2000	1.50	1.70	1.60

Table 6.

CENTER POND
STODDARD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
BOAT LANDING				
	2000	17.4	17.4	17.4
END CAMP BROOK				
	1988	23.4	23.4	23.4
	1989	19.2	20.0	19.6
	1990	17.0	19.5	17.8
	1991	17.6	23.7	20.6
	1992	18.2	18.5	18.4
	1993	18.4	22.8	20.6
	1994	19.6	24.2	21.9
	1995	16.4	21.0	18.7
	1996	19.8	19.8	19.8
	1998	16.1	16.1	16.1
	1999	21.0	21.0	21.0
	2000	19.5	19.7	19.6
EPILIMNION				
	1988	18.4	18.4	18.4
	1989	20.1	21.0	20.5
	1990	18.7	19.9	19.3
	1991	19.9	20.1	20.0
	1992	17.5	20.3	19.1
	1993	19.3	20.4	19.8
	1994	20.0	20.9	20.3
	1995	19.5	20.2	19.9
	1996	19.5	19.5	19.5
	1997	18.3	18.3	18.3

Table 6.

CENTER POND
STODDARD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1998	17.2	17.2	17.2
	1999	21.1	21.1	21.1
	2000	19.7	19.7	19.7
HYPOLIMNION				
	1988	22.2	22.2	22.2
	1989	23.0	27.6	25.0
	1990	21.2	22.6	21.7
	1991	21.9	28.7	24.1
	1992	20.3	22.0	21.4
	1993	19.7	22.6	20.8
	1994	22.2	26.0	23.4
	1995	20.8	21.3	21.1
	1996	22.7	22.7	22.7
	1997	20.9	20.9	20.9
	1998	29.3	29.3	29.3
	1999	23.3	23.3	23.3
	2000	22.1	30.1	26.1
LAUNCH INLET				
	1988	18.5	18.5	18.5
	1989	18.4	19.2	18.8
	1990	20.4	20.4	20.4
	1991	17.7	20.7	19.5
LEFT OUTLET				
	1988	18.5	18.5	18.5
	1989	20.6	20.6	20.6

Table 6.

CENTER POND
STODDARD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1988	19.3	19.3	19.3
	1989	21.9	22.8	22.2
	1990	19.6	20.3	20.0
	1991	19.6	20.2	19.8
	1992	19.7	20.4	20.0
	1993	19.2	21.1	20.2
	1994	20.2	32.4	24.3
	1995	18.9	20.1	19.6
	1996	20.1	20.1	20.1
	1997	19.2	19.2	19.2
	1998	20.7	20.7	20.7
	1999	22.1	22.1	22.1
	2000	21.9	22.2	22.1
OUTLET				
	1989	19.7	20.3	20.0
	1990	19.3	20.2	19.6
	1991	19.9	20.3	20.1
	1992	19.7	20.5	20.2
	1994	20.1	20.7	20.4
	1995	19.0	20.3	19.6
	1997	18.8	18.8	18.8
	1999	21.2	21.2	21.2
	2000	19.9	19.9	19.9

Table 8.

CENTER POND
STODDARD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
BOAT LANDING				
	2000	25	25	25
END CAMP BROOK				
	1988	18	18	18
	1989	4	42	23
	1990	13	43	28
	1991	14	27	20
	1992	22	24	22
	1993	17	26	21
	1994	15	26	20
	1995	12	19	16
	1996	12	12	12
	1998	16	16	16
	1999	4	4	4
	2000	5	6	5
EPILIMNION				
	1988	9	9	9
	1989	10	16	13
	1990	13	21	16
	1991	7	16	11
	1992	8	11	9
	1993	7	10	8
	1994	10	15	13
	1995	4	14	10
	1996	11	11	11
	1997	8	8	8

Table 8.

CENTER POND
STODDARD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1998	11	11	11
	1999	6	6	6
	2000	6	7	6
HYPOLIMNION				
	1988	32	32	32
	1989	11	31	22
	1990	20	126	56
	1991	13	21	18
	1992	21	34	26
	1993	13	19	17
	1994	23	35	29
	1995	15	23	20
	1996	19	19	19
	1997	19	19	19
	1998	21	21	21
	1999	15	15	15
	2000	8	19	13
LAUNCH INLET				
	1988	31	31	31
	1989	29	56	42
	1990	30	30	30
	1991	6	58	30
LEFT OUTLET				
	1988	6	6	6
	1989	150	150	150

Table 8.

CENTER POND
STODDARD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1988	17	17	17
	1989	13	18	15
	1990	18	23	21
	1991	8	16	10
	1992	7	9	8
	1993	7	18	12
	1994	11	14	13
	1995	9	14	11
	1996	16	16	16
	1997	10	10	10
	1998	17	17	17
	1999	8	8	8
	2000	10	11	10
OUTLET				
	1989	12	13	12
	1990	9	14	10
	1991	8	16	12
	1992	6	8	7
	1994	12	12	12
	1995	6	17	13
	1997	11	11	11
	1999	5	5	5
	2000	5	5	5

Table 9.

CENTER POND
STODDARD

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
	August 30, 2000		
0.1	21.7	8.5	96.2
1.0	21.6	8.4	95.2
2.0	21.4	8.2	92.6
3.0	19.9	7.5	82.7
4.0	18.6	5.0	53.3
5.0	14.1	0.7	6.5
6.0	11.1	0.8	7.2
7.0	9.4	1.0	8.9

Table 10.

CENTER POND

STODDARD

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 13, 1989	6.0	9.2	4.2	36.0
July 10, 1990	7.0	8.5	1.7	14.5
June 20, 1991	8.0	7.4	0.2	1.7
June 29, 1992	7.0	6.8	0.3	2.5
June 30, 1993	6.5	9.0	1.9	16.0
July 25, 1994	7.0	8.7	0.3	3.0
June 12, 1995	7.0	7.5	1.1	9.0
July 16, 1996	7.5	8.5	0.9	7.0
July 24, 1997	9.0	8.9	0.4	3.0
July 21, 1998	8.0	7.7	0.1	0.0
July 12, 1999	7.5	8.4	0.8	6.7
August 30, 2000	7.0	9.4	1.0	8.9

Table 11.

CENTER POND
STODDARD

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
BOAT LANDING				
	2000	0.4	0.4	0.4
END CAMP BROOK				
	1998	0.5	0.5	0.5
	1999	0.4	0.4	0.4
	2000	0.3	0.3	0.3
EPILIMNION				
	1997	0.3	0.3	0.3
	1998	0.5	0.5	0.5
	1999	0.5	0.5	0.5
	2000	0.3	0.4	0.3
HYPOLIMNION				
	1997	4.2	4.2	4.2
	1998	1.6	1.6	1.6
	1999	1.5	1.5	1.5
	2000	0.6	1.2	0.9
METALIMNION				
	1997	0.5	0.5	0.5
	1998	1.1	1.1	1.1
	1999	0.7	0.7	0.7
	2000	0.5	0.6	0.5
OUTLET				
	1997	0.3	0.3	0.3
	1999	0.4	0.4	0.4
	2000	0.2	0.2	0.2